12th safepork 2017
12th International Symposium on the Epidemiology and Control of Biological, Chemical and Physical Hazards in Pigs and Pork
Foz do Iguaçu - Brazil | August 21-24, 2017

ANTIMICROBIAL RESISTANCE PROFILING OF *SALMONELLA ENTERICA* DISTINCT SEROTYPES ISOLATED FROM PORK IN SÃO PAULO

Luisa Z. Moreno[1], Vasco T.M. Gomes[1], Ana Paula S. Silva[1], Maria Gabriela X. Oliveira[1], Carlos E. C. Matajira[1], Pedro H. L. N. Filsner[1], André P. Poor[1], Ana Paulo G. Christ[2], Mikaela R. F. Barbosa[2], Maria Inês Z. Sato[2], Andrea M. Moreno[1]

[1]*Universidade de São Paulo, Faculdade de Medicina Veterinária e Zootecnia (FMVZ-USP), São Paulo/SP, Brasil*
[2]*Companhia Ambiental do Estado de São Paulo (CETESB), São Paulo/SP, Brasil*

Introduction

Salmonellosis still is one of the most important worldwide zoonosis due to its high endemicity, mortality, and difficulty in control (Stevens et al., 2009). In the São Paulo city, different realities regarding good production practices and quality control of animal products coexists, especially when considering points of direct consumer sales. The aim of this study was to evaluate the antimicrobial resistance profiles of *Salmonella enterica* distinct serotypes isolated from pork in São Paulo.

Material and methods

A total of 60 *Salmonella enterica* strains were studied. The strains were isolated from pork cuts sold in butchers and small markets distributed among five regions of São Paulo city during the period of 2013 to 2016. The strains were submitted to antimicrobial resistance profiling by broth microdilution technique according to CLSI (2016) using Sensititre® standard susceptibility MIC plate EUVSEC (TREK Diagnostic Systems/Thermo Fisher Scientific). The strains were also serotyped through slide agglutination (Popoff, 1998). The association among strains origin, serotype and resistance profile was assessed through cluster analysis using Bionumerics 7.6 (Applied Maths NV).

Results

The most prevalent identified serotypes were Typhimurium (33.3%), London (26.7%) and Brandenburg (10.0%), followed by Schwaezengrund (8.3%), Derby (8.3%), Infantis (6.7%) and Javiana (6.7%). Only three markets were positive for more than one serotype. All strains were resistant to azithromycin and 98.3% to sulfamethoxazole; 55% of strains were classified as multiresistant (Tables 1 and 2). Resistance profiles cluster analysis enabled differentiation of two main groups: one group (A) comprising 28 strains presenting resistance to four to eight antimicrobial classes, and the other (group B) composed mostly by strains resistant to only two antimicrobial classes (Figure 1).

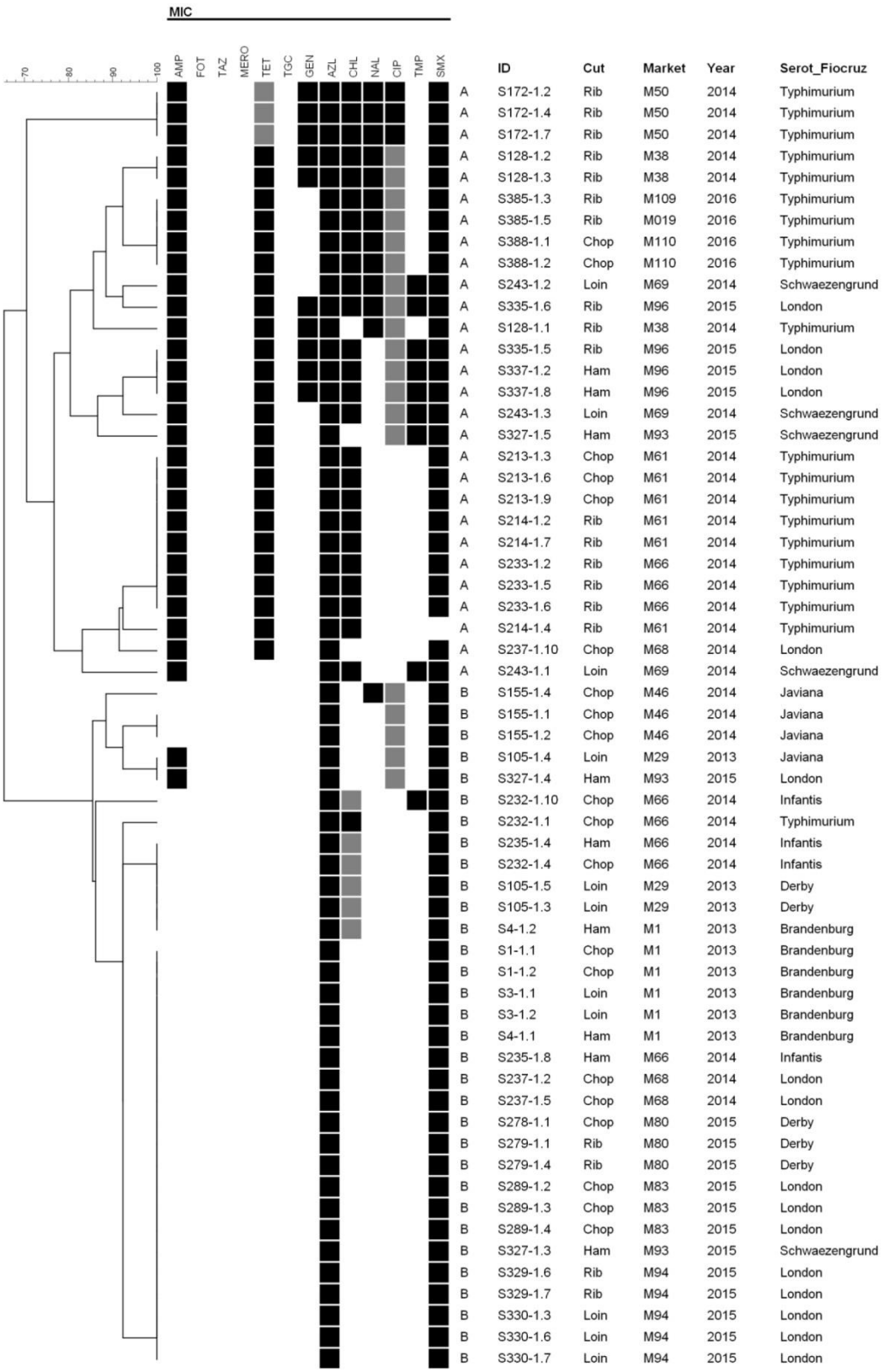
Table 1. MIC range, MIC_{50}, MIC_{90}, resistance rates and applied breakpoints against tested antibiotics.

Antimicrobial	MIC range[1]	MIC_{50}	MIC_{90}	Resistance N (%)	MIC breakpoints		
					S	I	R
Ampicillin	1 – 64	4	> 64	30 (50,0)	≤ 8	16	≥ 32
Cefotaxime	0,25 - 4	≤ 0,25	0,5	0	≤ 1	2	≥ 4
Ceftazidime	0,5 – 8	≤ 0,5	1	0	≤ 4	8	≥ 16
Colistin	1 – 16	≤ 1	≤ 1	1 (1,7)	-	-	≥ 4
Meropenem	0,03 – 16	≤ 0,03	≤ 0,03	0	≤ 1	2	≥ 4
Tetracycline	2 – 64	4	> 64	24 (40,0)	≤ 4	8	≥ 16
Tigecycline *	0,25 – 8	≤ 0,25	0,5	0	≤ 2	4	≥ 8
Gentamicin	0,5 – 32	1	> 32	10 (16,7)	≤ 4	8	≥ 16
Azithromycin	2 – 64	> 64	> 64	60 (100)	≤ 16	-	≥ 32
Chloramphenicol	8 – 128	16	> 128	25 (41,7)	≤ 8	16	≥ 32
Nalidixic acid	4 – 128	≤ 4	> 128	13 (21,7)	≤ 16	-	≥ 32
Ciprofloxacin	0,015 – 8	0,03	0,5	3 (5,0)	≤ 0,06	0,12 – 0,5	≥ 1
Trimethoprim	0,25 – 32	0,5	> 32	9 (15,0)	≤ 8	-	≥ 16
Sulfamethoxazole	8 - 1024	> 1024	> 1024	59 (98,3)	≤ 256	-	≥ 512

1 Sensititre™ EUVSEC MIC plate antimicrobials range. * Tigecycline breakpoint retrieved from FDA document NDA 21-821/S-016.

Table 2. Strain distribution according to resistance profile and isolation year.

Resistance profile	2013	2014	2015	2016	Total
≤ 2 classes	8	7	12	-	27
3 - 4 classes	1	4	1	-	6
≥ 5 classes	-	18	5	4	27
Total	9	29	18	4	60



	ID	Cut	Market	Year	Serot_Fiocruz
A	S172-1.2	Rib	M50	2014	Typhimurium
A	S172-1.4	Rib	M50	2014	Typhimurium
A	S172-1.7	Rib	M50	2014	Typhimurium
A	S128-1.2	Rib	M38	2014	Typhimurium
A	S128-1.3	Rib	M38	2014	Typhimurium
A	S385-1.3	Rib	M109	2016	Typhimurium
A	S385-1.5	Rib	M019	2016	Typhimurium
A	S388-1.1	Chop	M110	2016	Typhimurium
A	S388-1.2	Chop	M110	2016	Typhimurium
A	S243-1.2	Loin	M69	2014	Schwaezengrund
A	S335-1.6	Rib	M96	2015	London
A	S128-1.1	Rib	M38	2014	Typhimurium
A	S335-1.5	Rib	M96	2015	London
A	S337-1.2	Ham	M96	2015	London
A	S337-1.8	Ham	M96	2015	London
A	S243-1.3	Loin	M69	2014	Schwaezengrund
A	S327-1.5	Ham	M93	2015	Schwaezengrund
A	S213-1.3	Chop	M61	2014	Typhimurium
A	S213-1.6	Chop	M61	2014	Typhimurium
A	S213-1.9	Chop	M61	2014	Typhimurium
A	S214-1.2	Rib	M61	2014	Typhimurium
A	S214-1.7	Rib	M61	2014	Typhimurium
A	S233-1.2	Rib	M66	2014	Typhimurium
A	S233-1.5	Rib	M66	2014	Typhimurium
A	S233-1.6	Rib	M66	2014	Typhimurium
A	S214-1.4	Rib	M61	2014	Typhimurium
A	S237-1.10	Chop	M68	2014	London
A	S243-1.1	Loin	M69	2014	Schwaezengrund
B	S155-1.4	Chop	M46	2014	Javiana
B	S155-1.1	Chop	M46	2014	Javiana
B	S155-1.2	Chop	M46	2014	Javiana
B	S105-1.4	Loin	M29	2013	Javiana
B	S327-1.4	Ham	M93	2015	London
B	S232-1.10	Chop	M66	2014	Infantis
B	S232-1.1	Chop	M66	2014	Typhimurium
B	S235-1.4	Ham	M66	2014	Infantis
B	S232-1.4	Chop	M66	2014	Infantis
B	S105-1.5	Loin	M29	2013	Derby
B	S105-1.3	Loin	M29	2013	Derby
B	S4-1.2	Ham	M1	2013	Brandenburg
B	S1-1.1	Chop	M1	2013	Brandenburg
B	S1-1.2	Chop	M1	2013	Brandenburg
B	S3-1.1	Loin	M1	2013	Brandenburg
B	S3-1.2	Loin	M1	2013	Brandenburg
B	S4-1.1	Ham	M1	2013	Brandenburg
B	S235-1.8	Ham	M66	2014	Infantis
B	S237-1.2	Chop	M68	2014	London
B	S237-1.5	Chop	M68	2014	London
B	S278-1.1	Chop	M80	2015	Derby
B	S279-1.1	Rib	M80	2015	Derby
B	S279-1.4	Rib	M80	2015	Derby
B	S289-1.2	Chop	M83	2015	London
B	S289-1.3	Chop	M83	2015	London
B	S289-1.4	Chop	M83	2015	London
B	S327-1.3	Ham	M93	2015	Schwaezengrund
B	S329-1.6	Rib	M94	2015	London
B	S329-1.7	Rib	M94	2015	London
B	S330-1.3	Loin	M94	2015	London
B	S330-1.6	Loin	M94	2015	London
B	S330-1.7	Loin	M94	2015	London

Figure 1. Dendrogram showing the relationship among the *Salmonella* serotypes resistance profiles.

The multiresistant group A comprised strains of serotypes Typhimurium, London and Schwaezengrund, while the Brandenburg, Derby, Infantis and Javiana serotypes were associated to strains with increased sensitivity profile (group B). No further relation between strains resistance profiles and origin, including isolation year, was observed.

The multiresistant strains were characterized as resistant to ampicillin, chloramphenicol and tetracycline, and presented variable resistance to gentamicin, nalidixic acid, trimethoprim-sulfamethoxazole and ciprofloxacin. The high resistance rates to antimicrobials traditionally indicated for human salmonellosis treatment and especially azithromycin, demand attention to the multiresistance dissemination in pork and its risks and implications to public health.

References

CLSI. Performances standards for antimicrobial disk and dilution susceptibility tests for bacteria isolated from animals, M1000S, 26rd edition, Wayne, PA, USA, 2016.

Stevens MP, et al. (2009). Philos Trans R Soc Lond B Biol Sci 364: 2709–2723.

Popoff MY, et al. (1998). Res Microbiol 151: 63–65.